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(54) Electromagnetic actuators for steering mechanisms of toys

(57) The actuating mechanism for a remote controlled device, for example a radio-controlled toy car, boat or aeroplane includes a movably mounted magnet (4) and a fixed electro-magnet (7). In a preferred form the movable magnet (4) is a permanent magnet mounted on a pivotable lever with one pole positioned between the two opposite poles of the electro-magnet. The electro-magnet is energisable with reversible polarity whereby the lever (3) can pivot in two opposed directions and, by means of a mechanical linkage (11, 13-15) transmit movement for example to a pair of steering wheels (12) of a toy vehicle. The electro-magnet is energised in response to radio signals from a control transmitter.

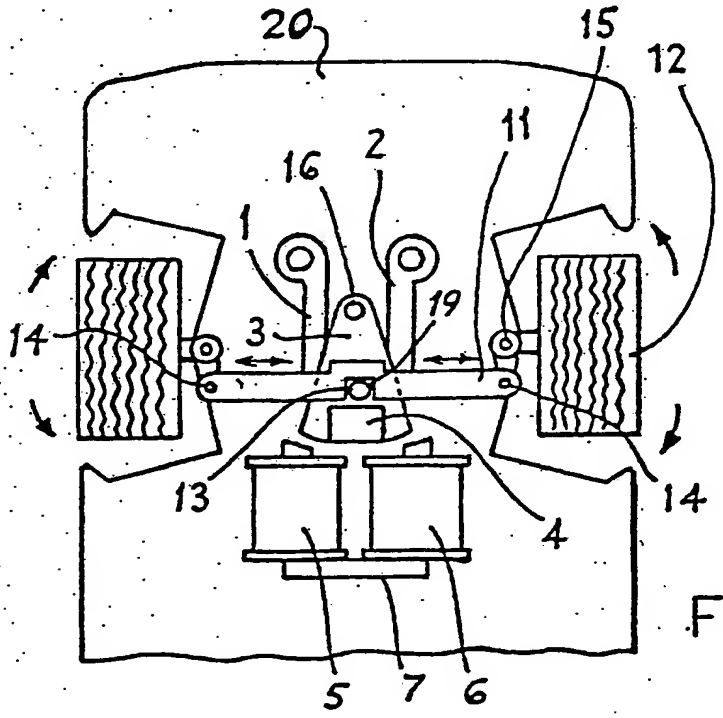

Fig.1

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The drawing(s) originally filed was (were) informal and the print here reproduced is taken from a later filed formal copy.
The claims were filed later than the filing date within the period prescribed by Rule 25(1) of the Patents Rules 1982.

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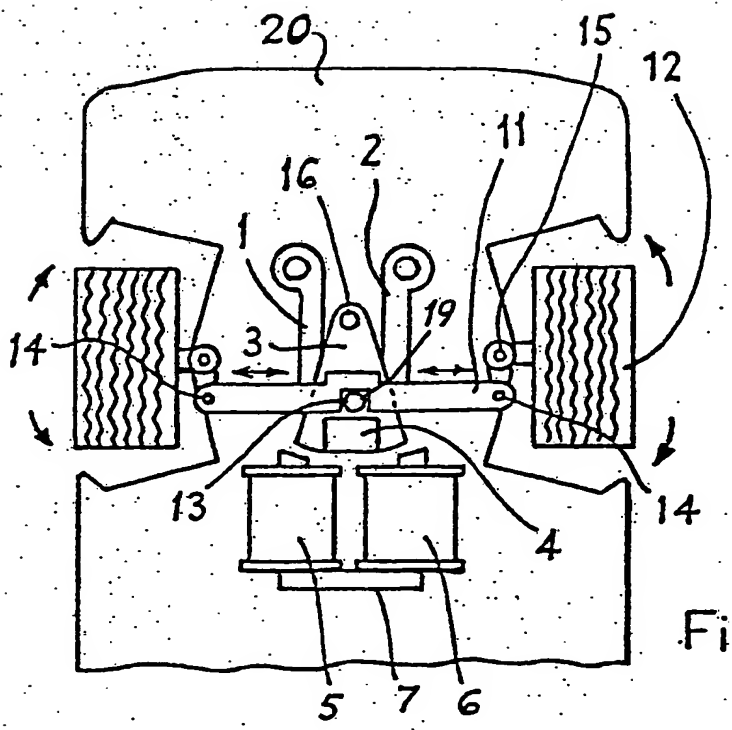

Fig.1

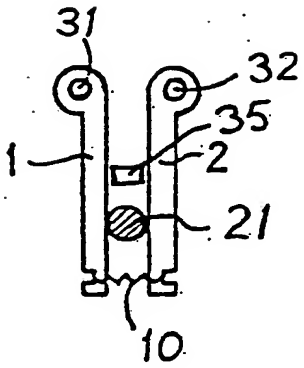

Fig.4

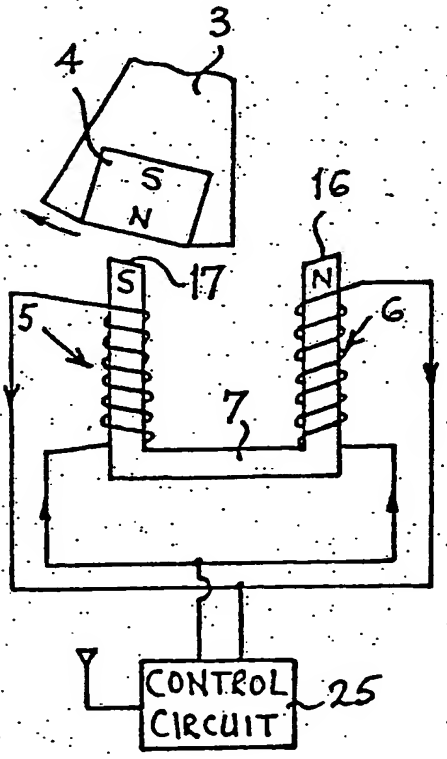

Fig.2

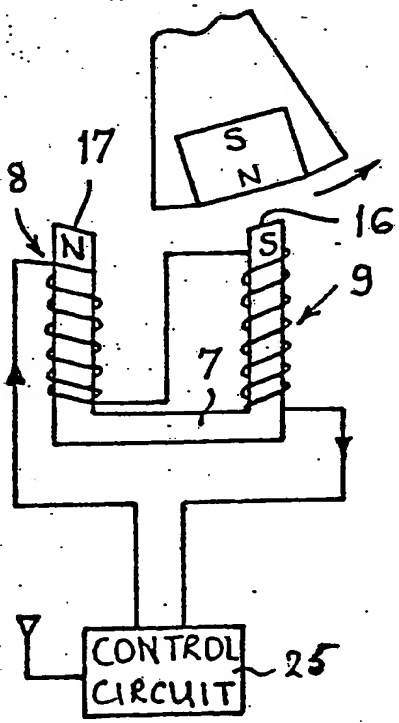

Fig.3

ACTUATING MECHANISM FOR REMOTE-CONTROLLED DEVICE

This invention relates to an actuating mechanism, typically a steering mechanism, for a remote-controlled device such as a toy car, boat or aeroplane and particularly to radio-controlled toys.

Radio-controlled toys generally have a radio receiver which receives signals from a transmitter held by an operator and convert the signals into mechanical movement, for example to change the angular position of a rudder or of a pair of wheels to steer the toy. There are also remote-controlled toy cars and the like wherein electrical control signals are transmitted to the toy through a wire.

Most existing actuating mechanisms of this type include a small drive motor which generates undesirable electrical noise. Other devices are known which use two permanent magnets which a single electrical coil and an E-shaped iron core. In such devices, the two permanent magnets are movable. This however is undesirable in view of the weight, and hence the inertia, of the two permanent magnets and also because of the high friction forces which render the device inefficient.

The present invention consists in an actuating mechanism for a remote-controlled device comprising a movably mounted magnet and a fixed magnet, one of said magnets being a permanent magnet and the other being an electromagnet, wherein the movable magnet is arranged to effect the desired actuation and is positioned sufficiently close to the fixed magnet for the respective fields of the two magnets to interact to cause movement of the movable magnet when the electromagnet is energised and wherein means are provided for energising the electromagnet with

reversible polarity in response to electrical or radio signals from a control unit such as a radio transmitter, energisation of the electromagnet with one polarity causing movement of the movable magnet in a first direction and energisation with the opposite polarity causing movement of the movable magnet in a second direction, thus allowing actuation of the device in two possible directions.

Preferably, the fixed magnet is the electromagnet. The movable magnet is preferably a permanent magnet mounted on a pivotable lever, the lever having a neutral position wherein one pole of the permanent magnet is positioned between the two poles of the electromagnet whereby energisation of the electromagnet with one polarity causes pivoting of the lever in a first direction and energisation with the opposite polarity causes movement of the lever in the opposite direction. The lever preferably has a mechanical linkage to the device to be actuated, and means for centering the lever between the two poles of the electromagnet when the latter is not energised.

Preferred embodiments of this invention will now be described with reference to the accompanying drawings wherein:-

Figure 1 is a plan view of the steering mechanism of a toy vehicle incorporating an actuating device in accordance with the invention;

Figures 2 and 3 illustrate two alternative arrangements for wiring the electromagnets shown in Figure 1, and

Figure 4 illustrates a centering device for the mechanism of Figure 1.

Figure 1 is a plan view of the steering mechanism of a toy vehicle 20 having a pair of steered wheels 12

each of which is mounted on a pivoting arm 15. Each of the pivoting arms is linked at 14 to a respective end of a tie bar 11. At a central part of the tie bar 11 is a square recess 19 which engages with a pin 13 projecting from a steering lever 3. This lever is secured to the floor of the vehicle by a pivot pin 16 and carried at its opposite end a permanent bar magent 4 with its North pole facing outwardly as shown in Figures 2 and 3.

It can be seen from Figure 1 that the pivoting movement of the lever 3 causes a reciprocal movement of the tie bar 11 which in turn pivots the wheels 12, via the pivot arms 15, to the left or to the right according to the direction of movement of the lever.

The lever is actuated by means of a U-shaped electromagnet 7 with reversible poles 16-17.

The electromagnet is energised with direct current from a control circuit 25 which processes incoming radio signals from a control transmitter or electrical signals transmitted by a wire from a remote control unit. The wiring of the electromagnet can be done in various ways, for example with coils 5,6 wired in parallel as in Figure 2 or with coils 8,9 wired in series as shown in Figure 3. In either case, the coils around the two legs of the U-shaped core are wound in opposite direction so that the free ends 16,17 are always of opposite polarity.

When the radio transmitter sends a signal for the toy car to make a right turn (i.e. with the wheels pivoting clockwise as seen in the plan view of Figure 1) the control circuit feeds to the electromagnet a direct current in the direction shown in Figure 2 whereby the free end 16 of the core is energised as a North pole and the free end 17 is energised as a South

pole. The permanent magnet 4, which has its North pole closest to the poles of the electromagnet, is drawn towards the South pole 17 thus causing the lever 3 to pivot to the left as seen in the drawings, and causing the tie bar 11 to move axially to the left thus pivoting the wheels so as to cause the vehicle to turn right. Similarly, when the current, and hence the polarity of the electromagnet, is reversed so that, as shown in Figure 3, the permanent magnet 4 and lever 3 pivot in the opposite direction, the tie bar 11 moves to the right as shown in Figure 1 and the wheels pivot anti-clockwise as seen in the same Figure (or clockwise as seen from above the vehicle) to make a left turn.

When the electromagnet is not energised, the permanent magnet 4 and lever 3 are centered between the poles of the electromagnet by a centering mechanism shown in Figure 4. This comprises a pair of centering levers 1,2 which are pivotally attached to the underside of the vehicle at 31 and 32. Their opposite ends are connected by a tension spring 10 which may be under slight tension even in the neutral centred position. A pin 21 projecting from the side of the lever 3 opposite to that seen in Figure 1 extends between the centering levers 1,2 which bear against it under the tension of the spring 10. A fixed stop or bar 35 is also provided between the levers. Movement of the lever 3 in either direction to steer the wheels causes one of the centering levers 1,2 to move with it. Since the other lever will be prevented from following it by the fixed stop 35, such movement will also increase the tension in the spring 10. The centering levers, together with the pin 21 and steering lever 3, are thus permanently biased back towards the neutral position in Figures 1 and 4.

The invention thus provides a simple mechanism which has a minimal number of moving parts and low inertia. The mechanism is thus quick to respond and frictional losses are low.

CLAIMS

1. An actuating mechanism for a remote-controlled device comprising a movably mounted magnet and a fixed magnet, one of the magnets being a permanent magnet and the other being an electro-magnet, wherein the movable magnet is arranged to effect the desired actuation and is positioned sufficiently close to the fixed magnet for the respective fields of the two magnets to interact to cause movement of the movable magnet when the electro-magnet is energised wherein means are provided for energising the electro-magnet with reversible polarity in response to electrical or radio signals from a control unit, energisation of the electro-magnet with one polarity causing movement of the movable magnet in a first direction and energisation with the opposite polarity causing movement of the movable magnet in a second direction, thus allowing actuation of the device of two possible directions.

2. An actuating mechanism according to claim 1 wherein the fixed magnet is the electro-magnet.

3. An actuating mechanism according to claim 1 or claim 2 wherein the movable magnet is mounted on a pivotable lever.

4. An actuating mechanism according to claim 3 wherein the lever has a mechanical linkage to the device to be actuated.

5. An actuating mechanism according to claim 4 wherein the linkage includes a pin on the pivotable lever which engages in a recess on a movable tie bar connected to the device to be actuated.

6. An actuating mechanism according to any one claims 3 to 5 wherein the pivotable lever carries the permanent magnet and has a neutral position in which one pole of the permanent magnet is positioned between the two poles of the electro-magnet.

7. An actuating mechanism according to claim 6 wherein the lever is biased towards its neutral position and moved out of the neutral position only when the electro-magnet is energised.

8. An actuating mechanism according to claim 7 wherein a pin on the pivoting lever projects between two centering levers which are pivotally mounted and connected together by a tension spring, and wherein a fixed stop projects between the centering levers whereby the tension spring biases the two centering levers inwardly towards the fixed stop, to a position corresponding to the neutral position of the pivotable lever carrying the movable magnet.

9. An actuating mechanism according to any preceding claim wherein the electro-magnet is U-shaped, a coil being wound around each leg and the windings being such as to impart opposite polarities to the two free ends of the legs of the electro-magnet.

10. An actuating device according to claim 9 wherein the two said coils are connected in parallel.

11. An actuating device according to claim 9 wherein the two said coils are connected in series.

12. An actuating device according to any preceding claim wherein the electro-magnet is arranged to be energised by a control circuit in response to signals received by an associated radio receiver.

13. An actuating mechanism for a remote controlled device, substantially as herein described with reference to figures 1 and 4 in conjunction with figure 2 or figure 3 of the accompanying drawings.

14. A remote controlled toy incorporating an actuating mechanism according to any preceding claim.

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